Flooding Control and Emergency Repairs

Lesson Topic 3.3

Enabling Objectives

1. Select the procedures necessary to control and repair damage to shipboard equipment and systems
2. Coordinate the activities of the damage control teams of the repair station
3. Select those activities which require coordination with other repair stations
4. Given a damage control scenario record damage control messages

Enabling Objectives

- Record casualties on DC diagrams
- Select the capabilities and operating characteristics of damage control equipment and system under normal and degraded conditions
- Match the following DC systems with their purpose and locations: 1 Firemain 2. Drainage 3. Ventilation 4. Casualty power

Enabling Objectives

- Discuss the coordination of the following repair station teams: Plugging, Pipe patching, Dewatering, & Shoring

Flooding Indications, causes and Sources

- Indications of Flooding
  - Loss of pressure
  - Reduction in level of water or fuel in tanks
  - list of ship
  - Soundings
  - Alarm systems
  - Visual indications

Battle damage

- Small/large holes
- Punctured, weakened bulkheads
- warped/sprung doors & hatches
- Ruptured/cracked pipes
- ruptured/weaken decks

Flooding Indications, causes and Sources

- Causes of flooding
  - Sea damage
    - Hurricanes
    - Typhoons
    - Tropic storms
  - Carelessness
    - water tight integrity
    - maintain material conditions
    - sound tanks and voids

Collisions at sea!!

Flooding Indications, causes and Sources

- Types of flooding
  - Solid
  - Partial, not completely flooded
    - Free surface exists
- Effects of pressure on flooding
  - Inward pressure on a hole submerged is .444 Pounds Per Square Inch (PSI) for every foot of depth in saltwater

Flooding Indications, causes and Sources

- Effects of Securing Sources of Flooding
  - Hasty deactivation may cause interference with fire fighting operations
  - Careful evaluation required prior to securing any systems

Establishing Flooding Boundaries

- Use the same theory as fire boundaries, except all boundaries are watertight
- Repair party personnel and investigators must keep re-inspecting after setting boundaries

Controlling Flooding using Portable and Installed Dewatering Systems

- Drainage systems
  - Total output of pumping equipment must be greater than flow of water into the compartment
  - The most practical goal is to reduce flow enough to permit effective pumping

Controlling Flooding using Portable and Installed Dewatering Systems

- Drainage System include
  - Main drainage
  - Secondary drainage
  - Plumbing, gravity and deck drains

Controlling Flooding using Portable and Installed Dewatering Systems

- Overboard discharge connections
  - Allow discharge of liquids through the hull of the ship
  - Located on DC deck or as close to the DC deck as practicable
  - Port and starboard sides
  - Flush with outer hull surface

Overboard discharge connections

- Size and type
  - 4" female swivel hose connection
  - 2 1/2" fire hose connection
  - A spanner wrench is stored on station

Controlling Flooding using Portable and Installed Dewatering Systems

- Eductors
  - Jet-type pumps that contain no moving parts
  - Used for pumping liquids that cannot be handled directly by portable pumps
  - Can handle liquids that contain fairly small particles of foreign matter

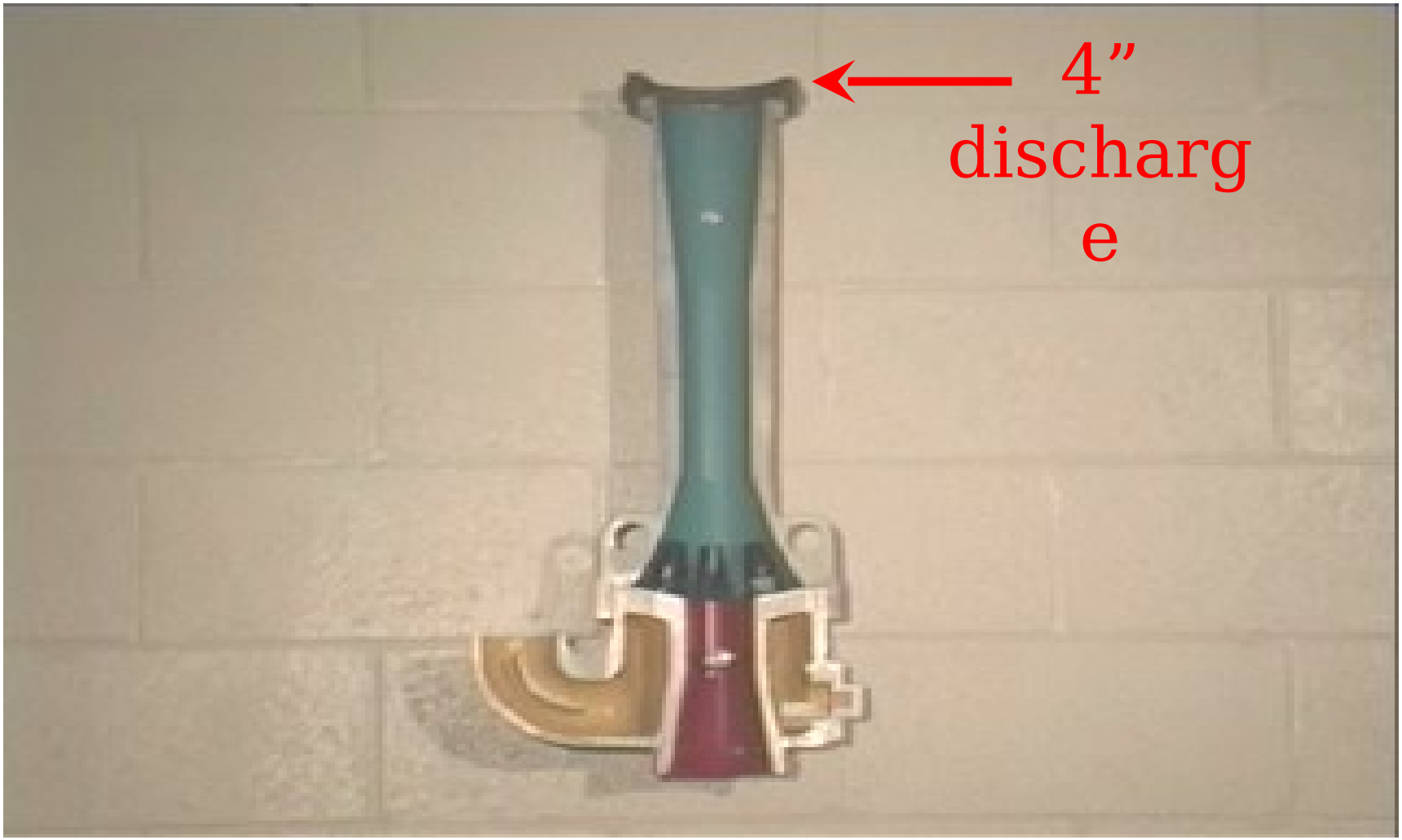
Eductors

- Peri-jet
  - Six jets around vacuum chamber
  - Straight bore of 2 1/2 inches
  - Allow debris up to 2 1/2 inches in diameter to pass through
  - no foot valve

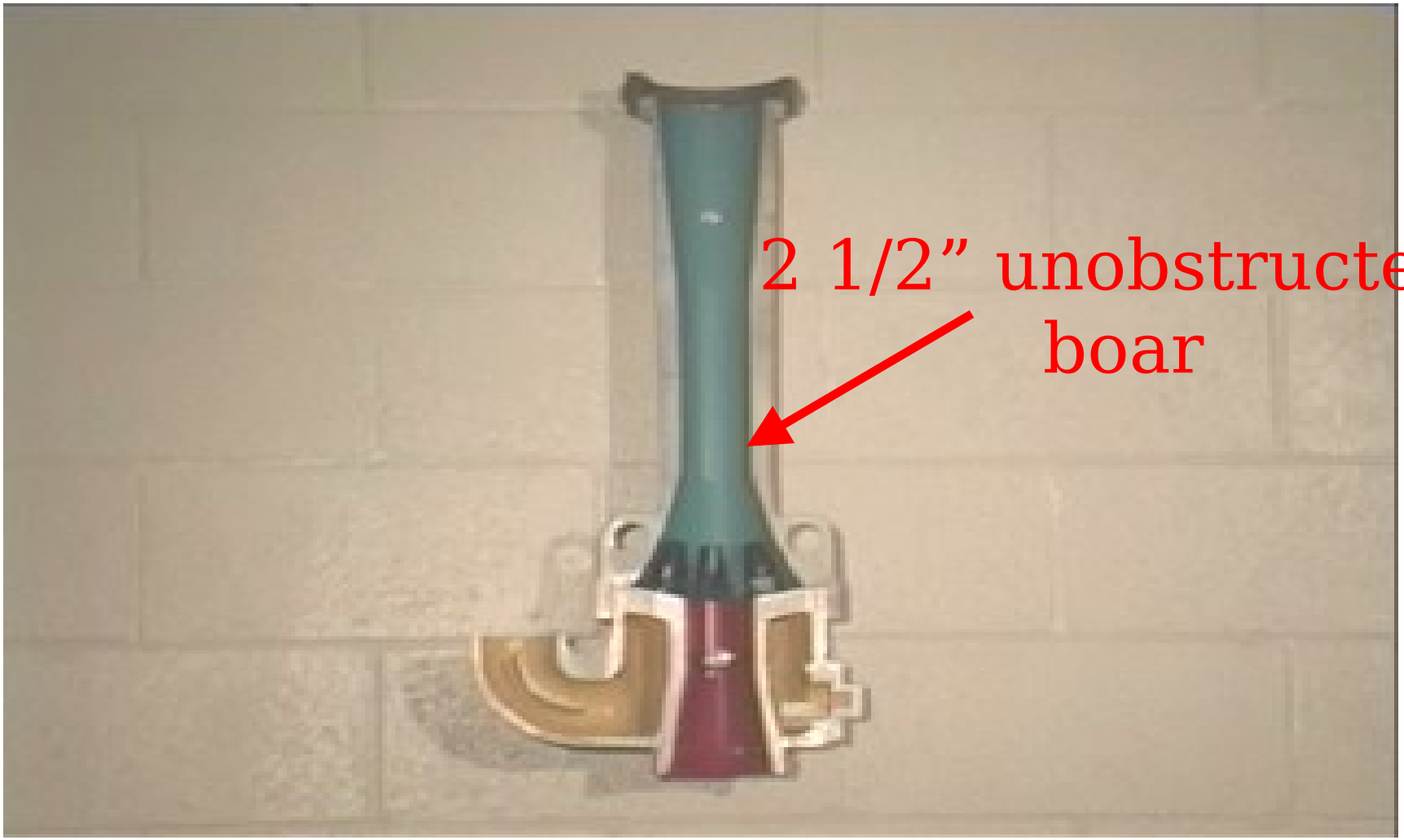
Peri Jet Eductor

Peri Jet Eductor cut-away

Peri Jet Eductor cut-away



Peri Jet Eductor cut-away



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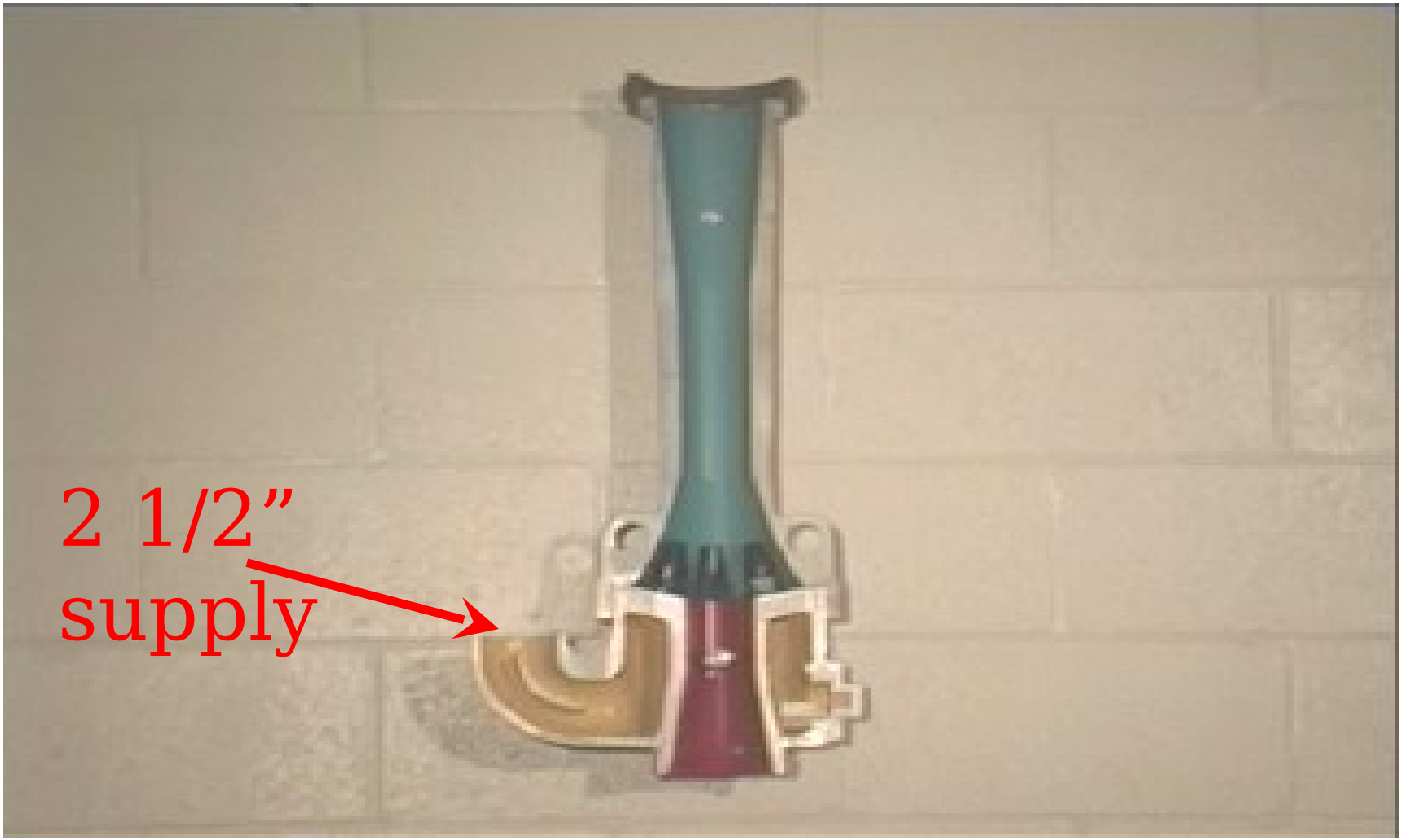


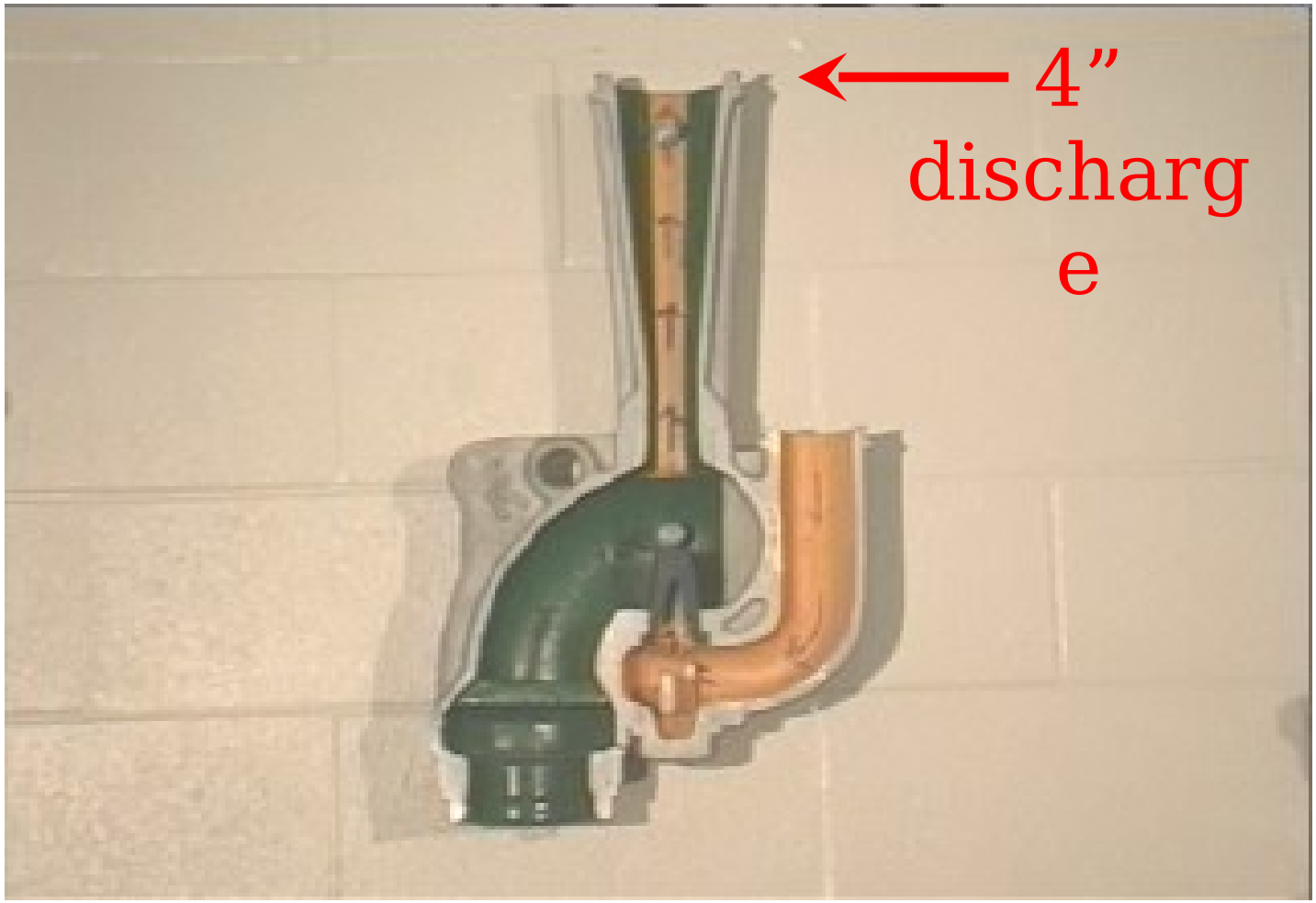
Peri Jet Eductor cut-away

Eductors

- S-type
  - One jet in vacuum chamber
  - Foot valve
  - Strainer attached and must be raised and lowered when it clogs with debris
  - 1 1/2 inch size available

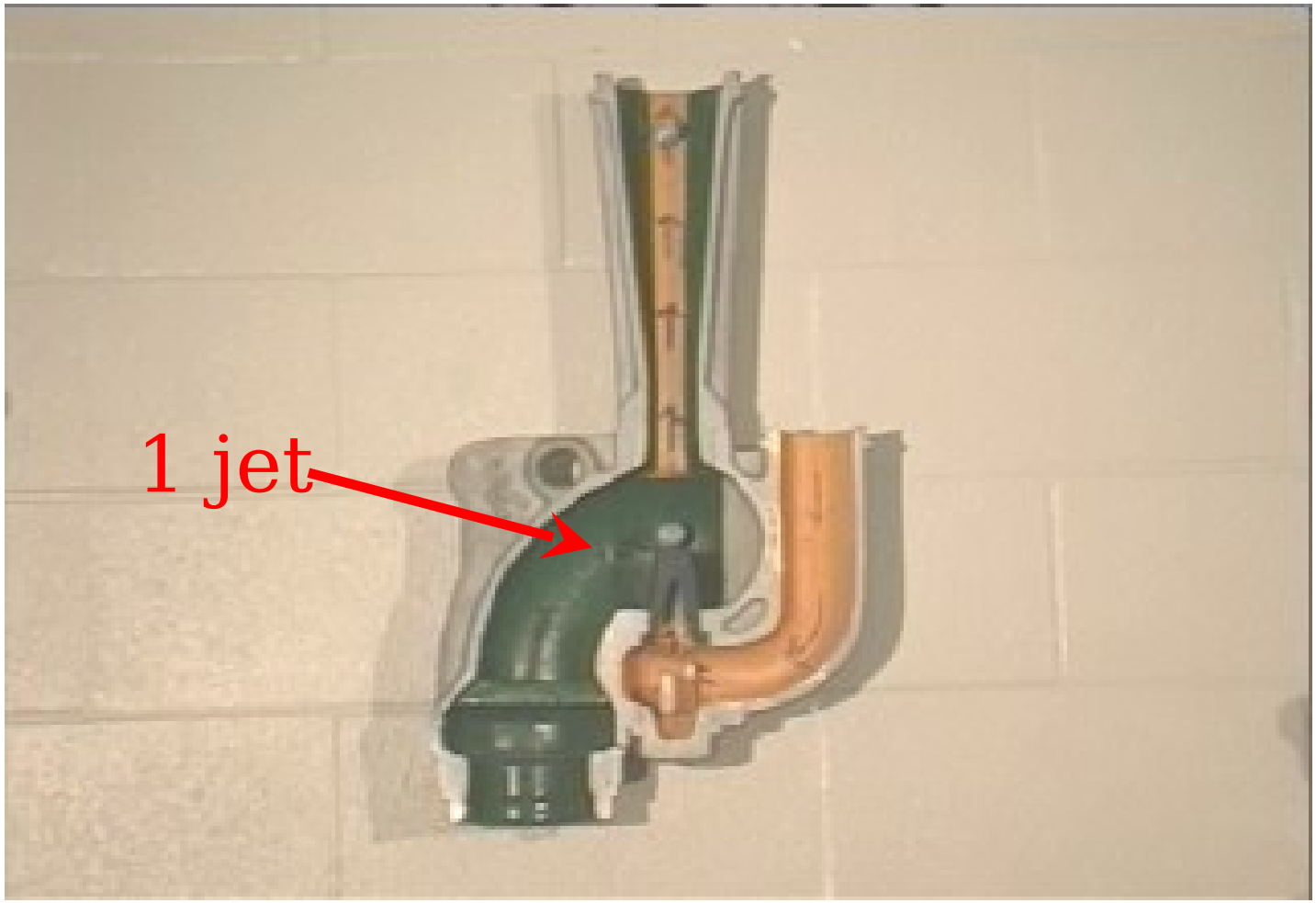
S type Eductor

S-type eductor cut-away

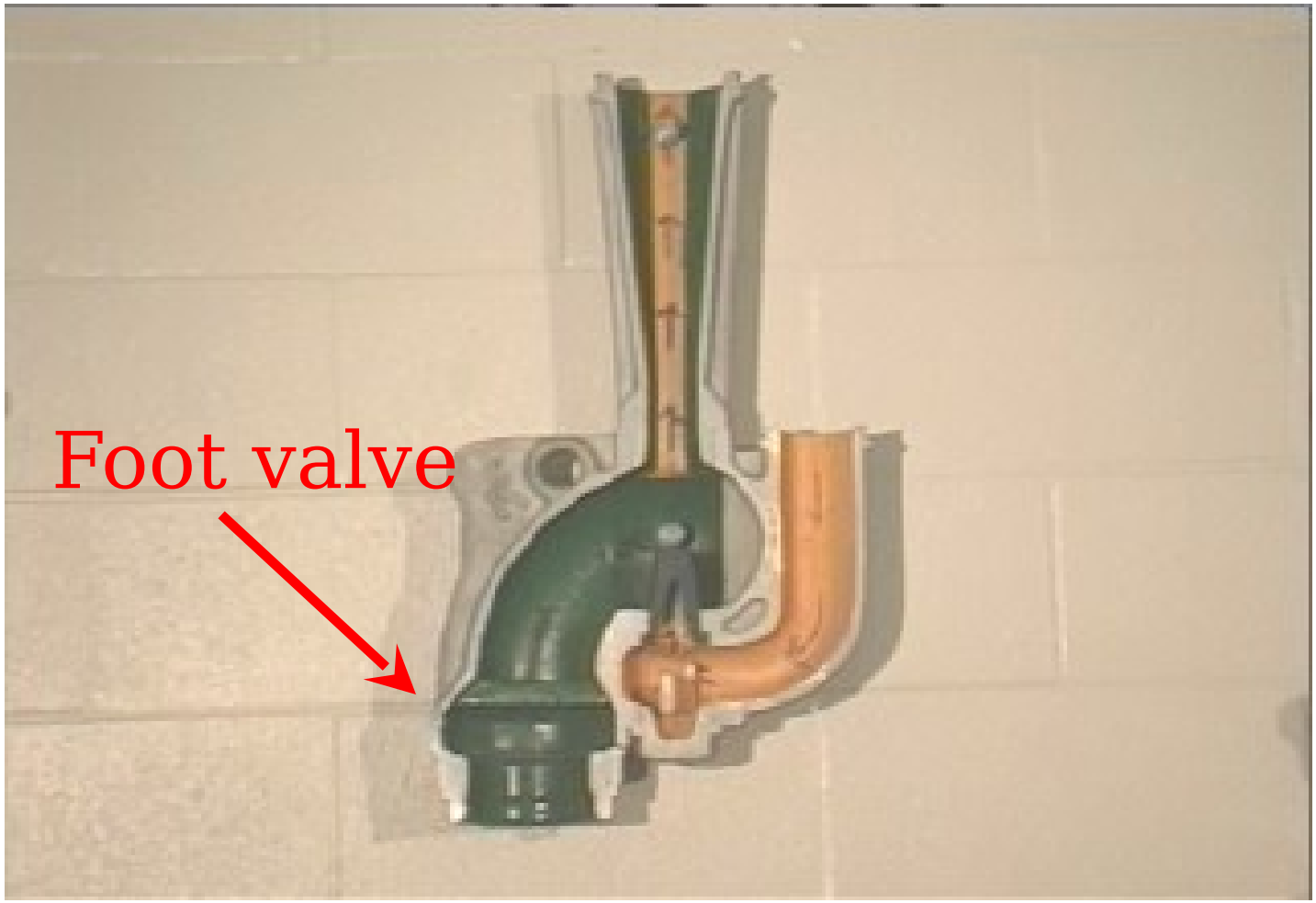


S-type eductor cut-away

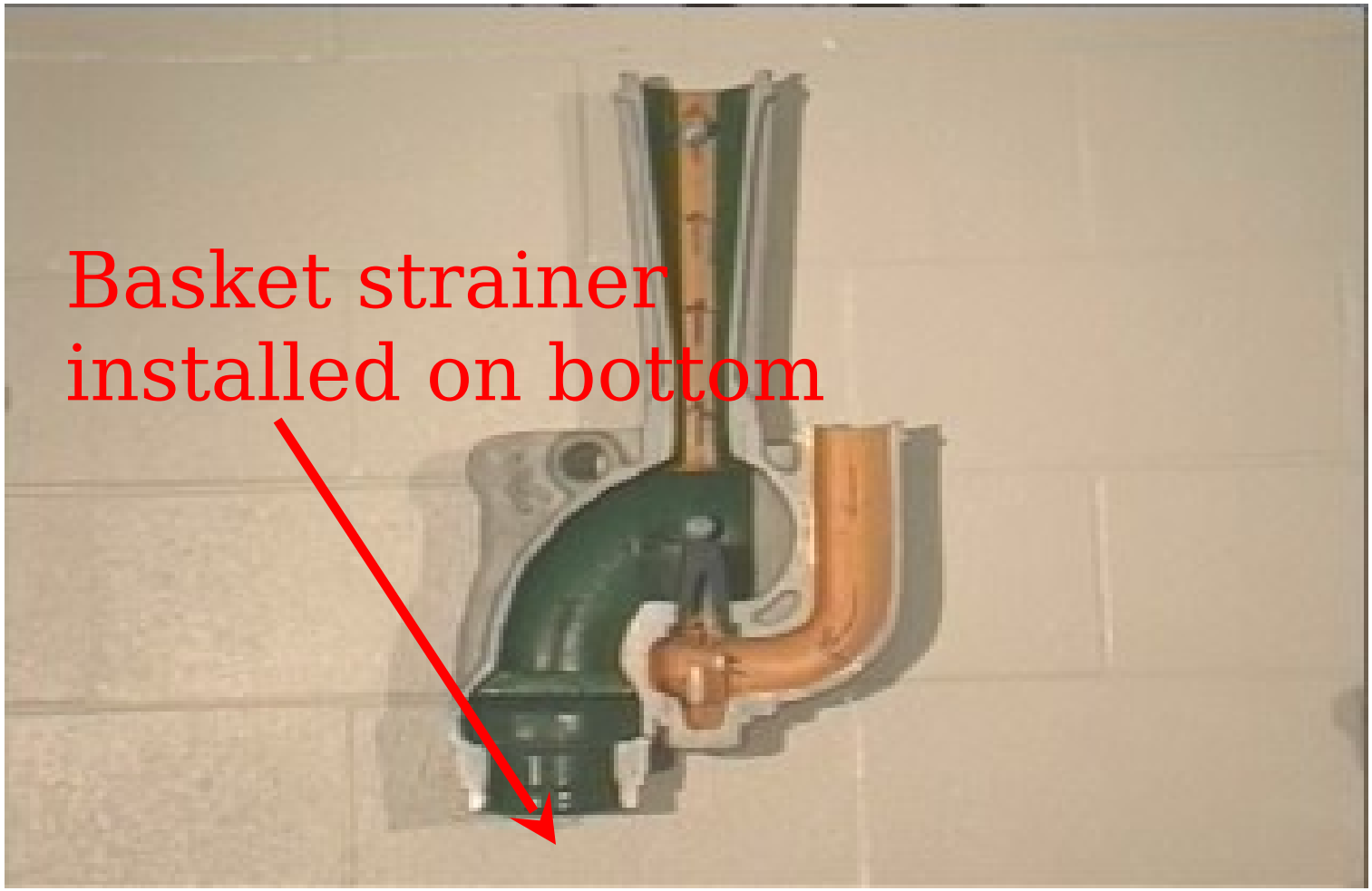
S-type eductor cut-away



S-type eductor cut-away



S-type eductor cut-away



Eductors

- Both eductors have
  - 4 inch discharges
  - Firemain pressure as motive power
  - 2 1/2 inch fire hose connections
  - Portable or fixed

Eductors

- Pressure of water supplied must be greater than the pressure against which the eductor must discharge
- Eductor formula:
  - Static head(FT) x .433 x 3 = PSI required
- Example
  - 50 x .433 x 3 = 64.95 PSI

P-100 portable pump

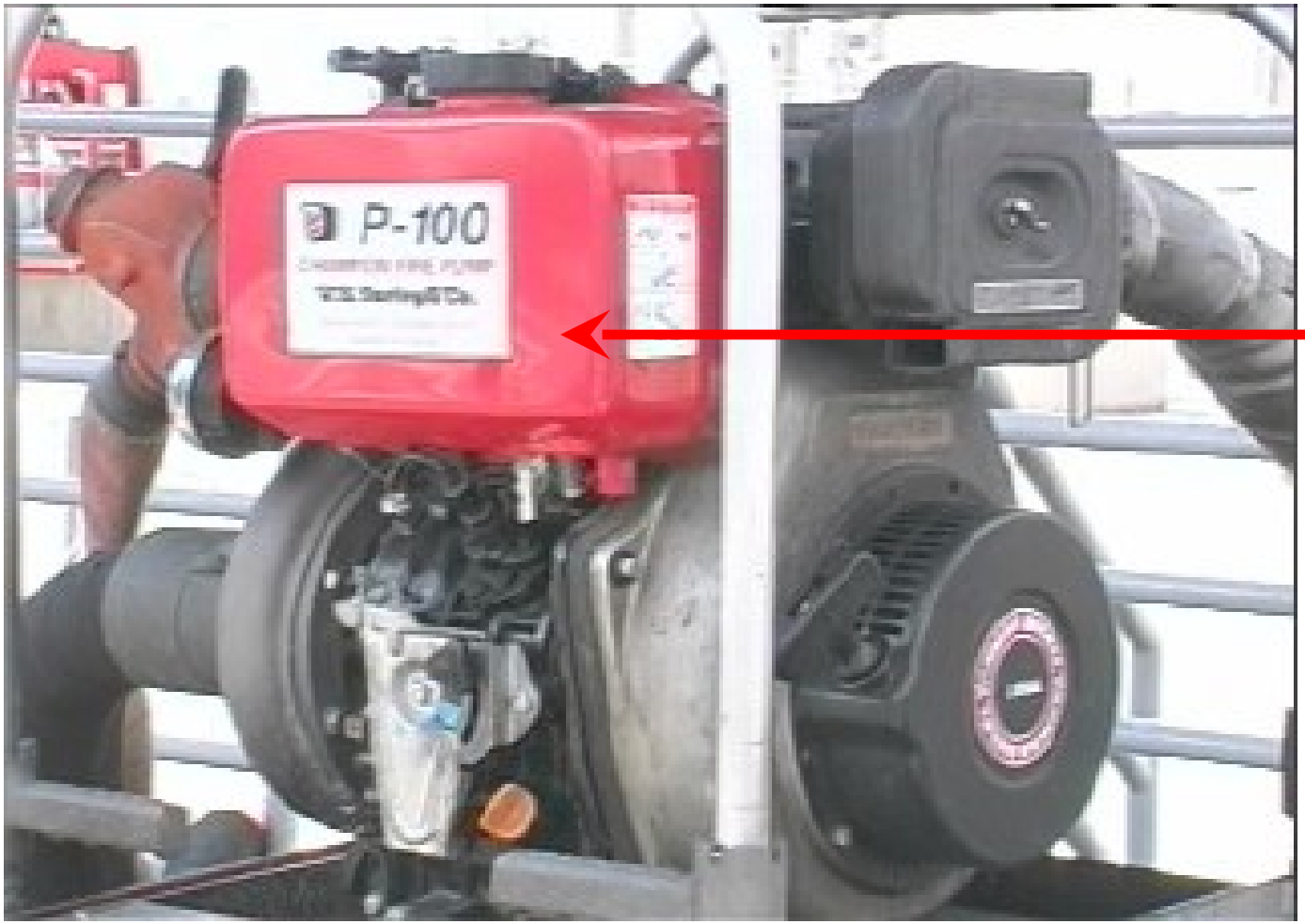
- Fire fighting & limited dewatering operations
- 100 GPM at 83 PSI
- Suction lift is 20 ft, suction lifts greater than 20 ft use Vita Motivator
- Vita Motivator similar to 1 1/2 S-type eductor

P-100 portable pump

- P-100 engine
  - Diesel engine
  - Single Cylinder engine
  - Four cycle
  - Air cooled
  - Fuel injected
  - 10 horse power at 3830 rpms

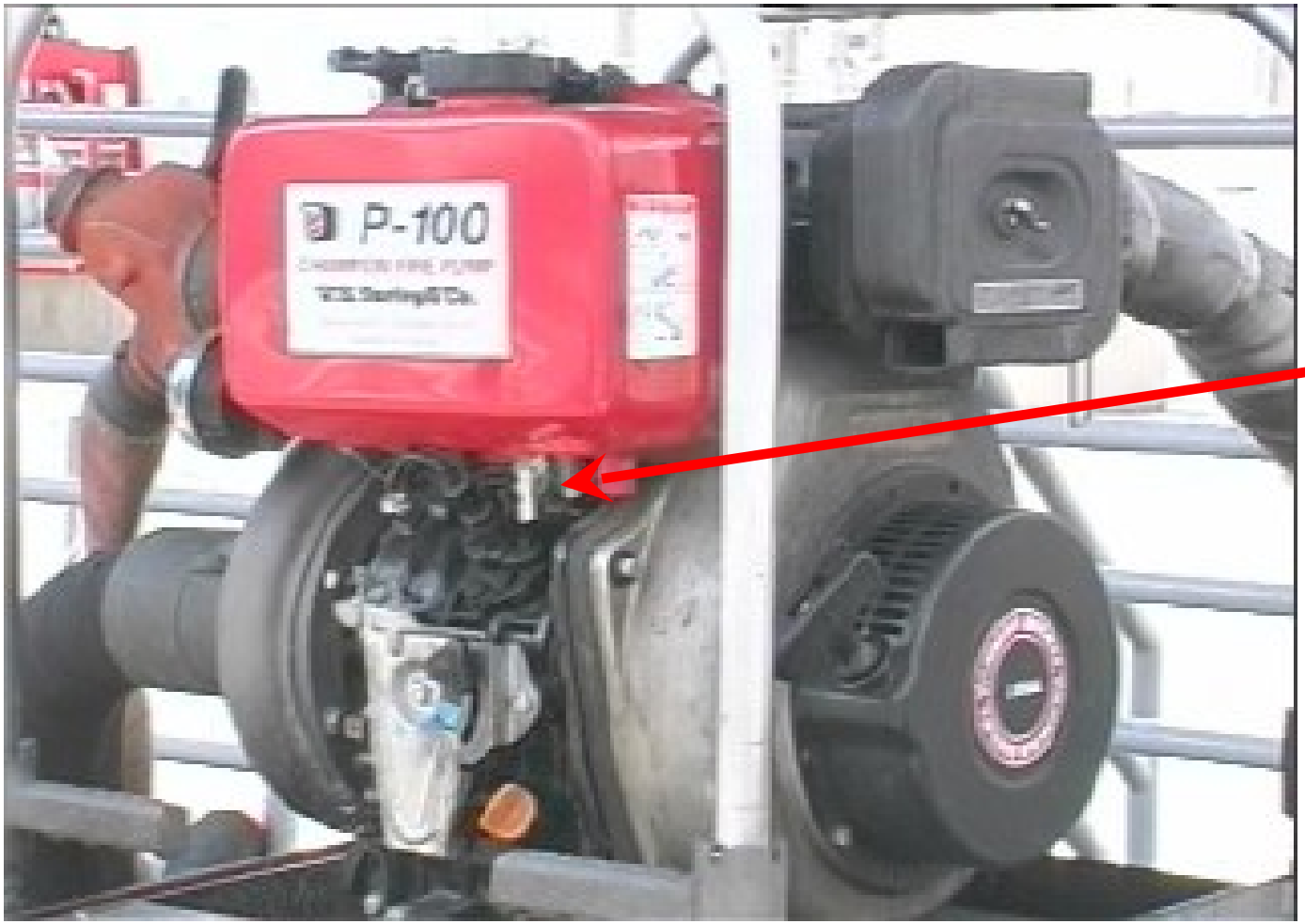
P-100 portable fire fighting pump

P-100 portable fire fighting pump



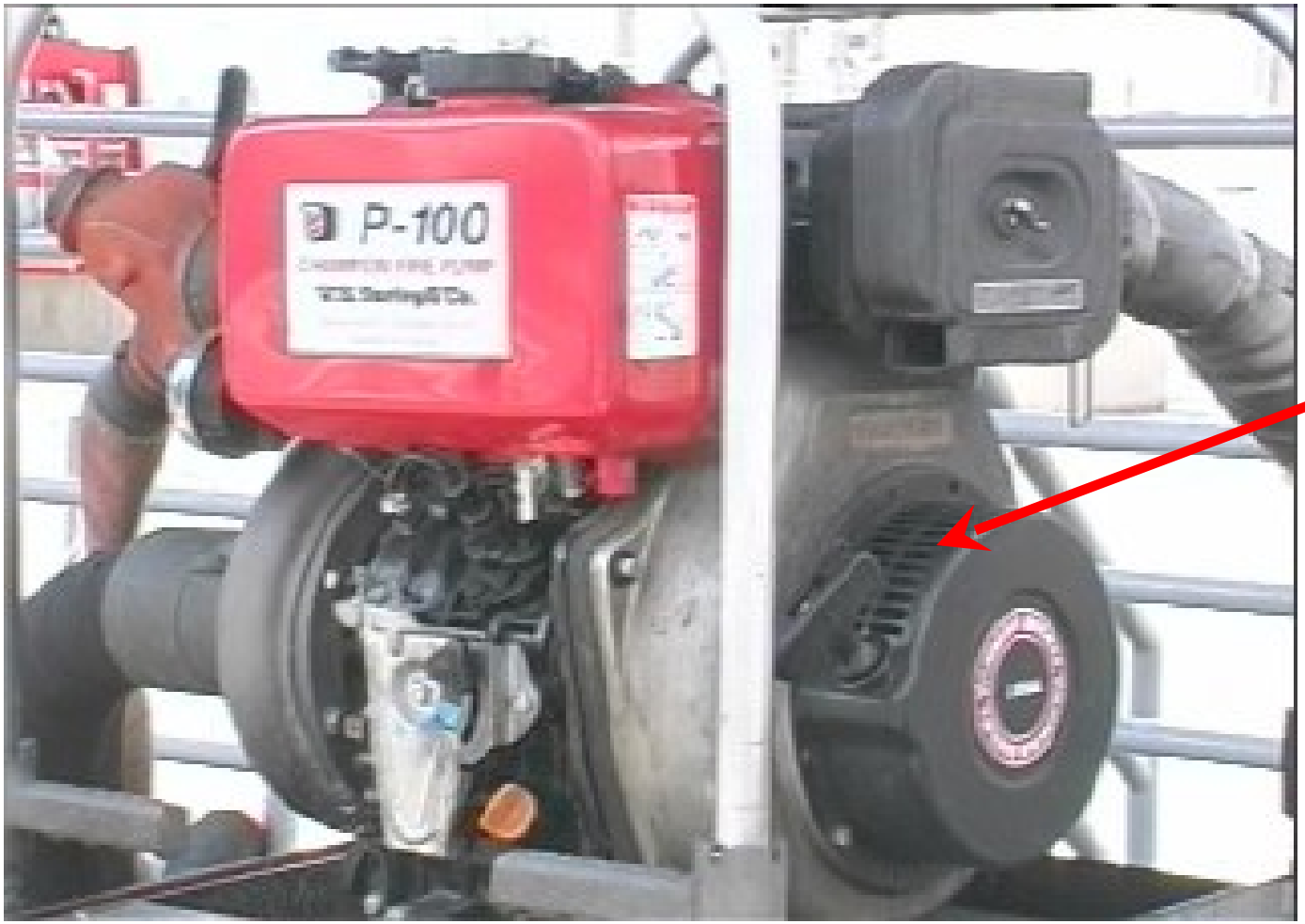
Fuel tank
1.45 gal

P-100 portable fire fighting pump

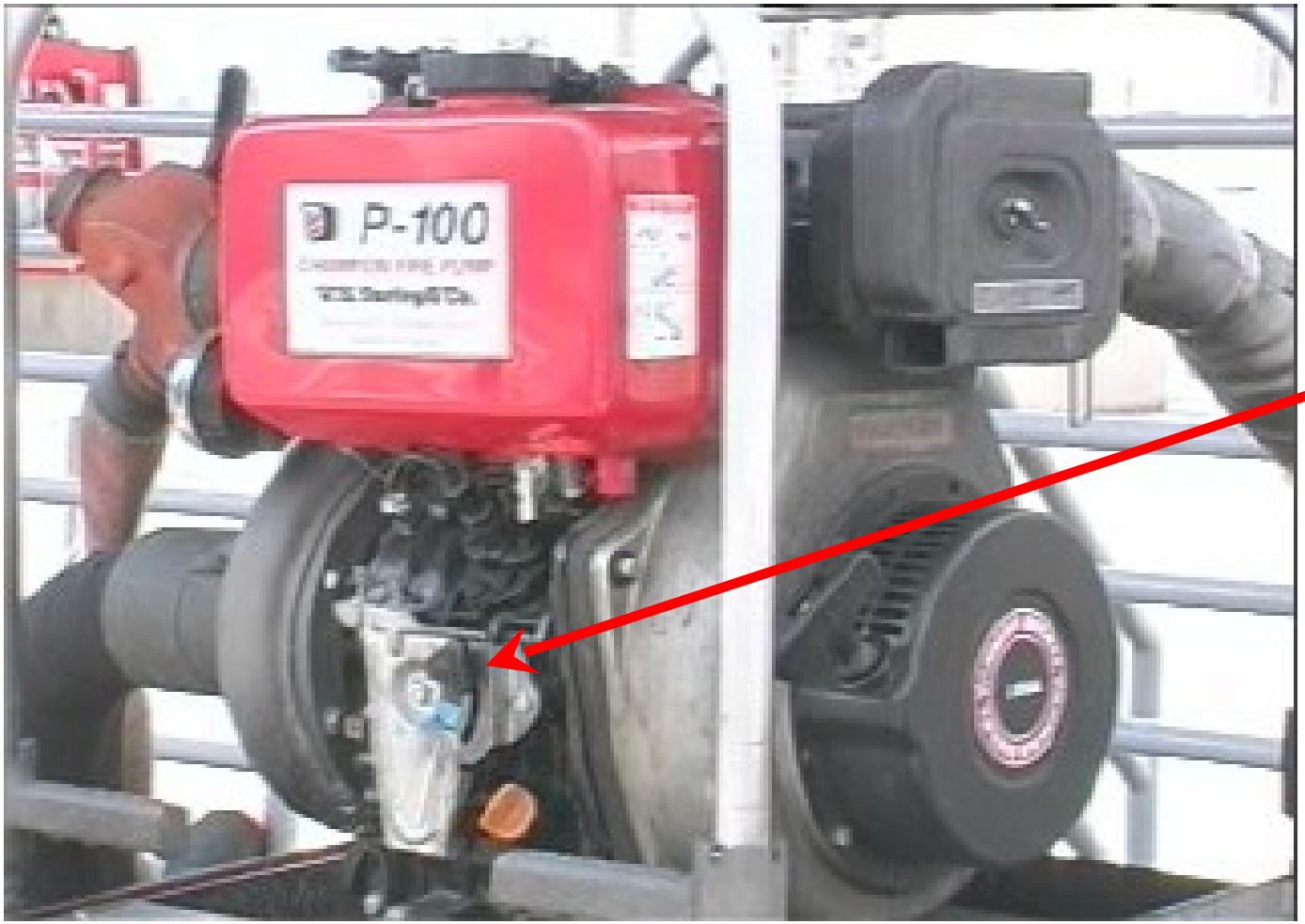


Fuel pet cock valve

P-100 portable fire fighting pump

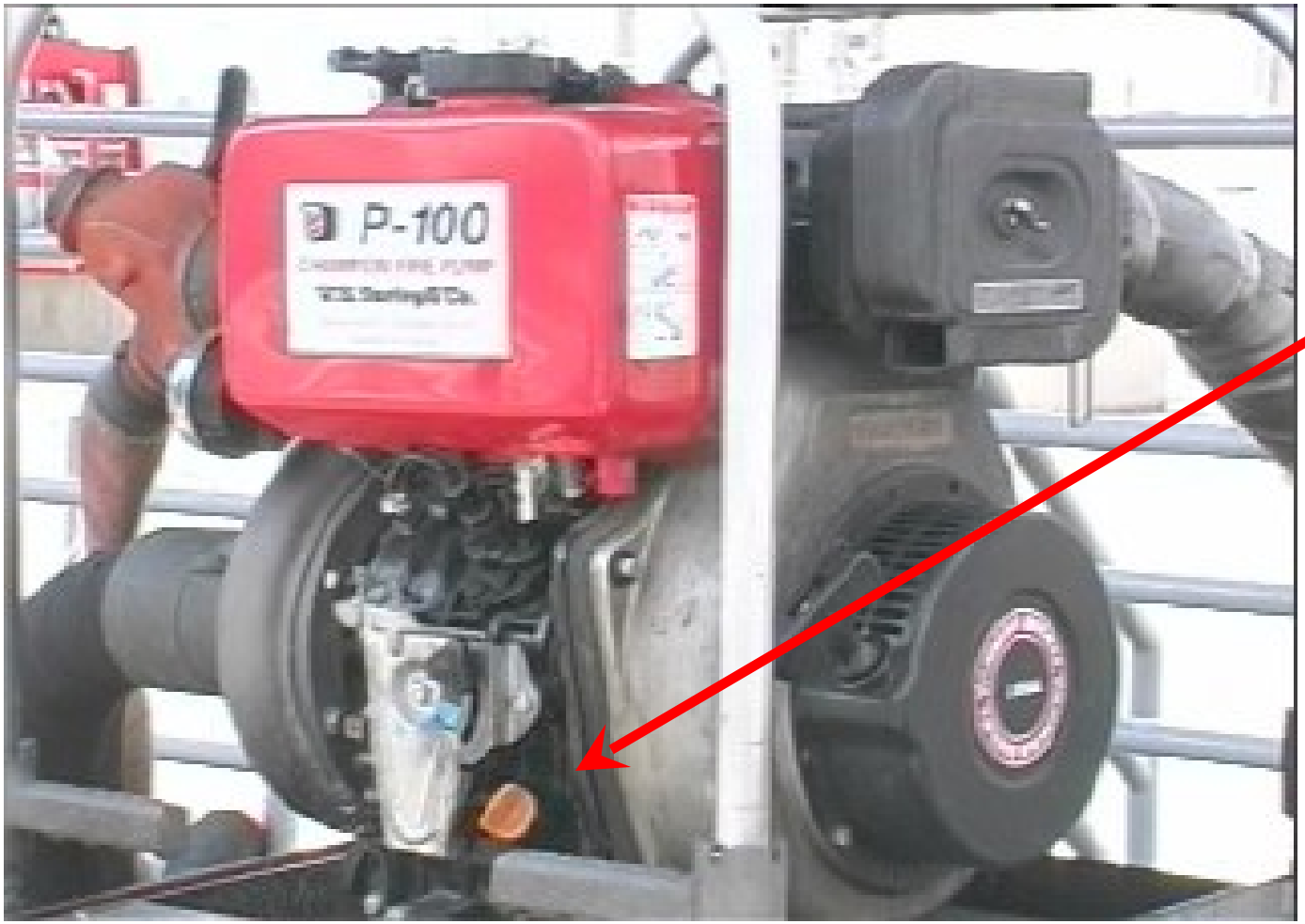


P-100 portable fire fighting pump



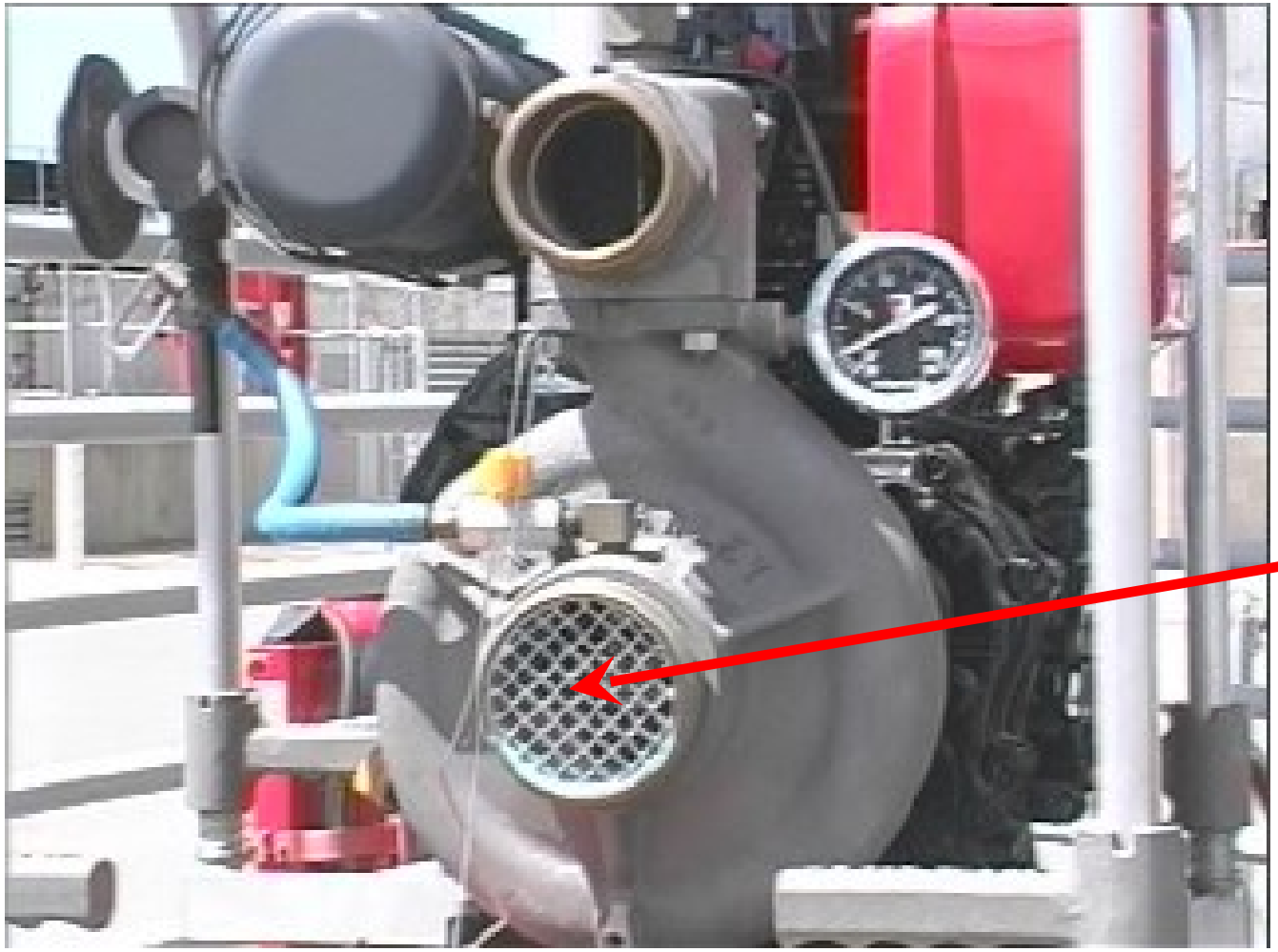
Run/start stop lever

P-100 portable fire fighting pump

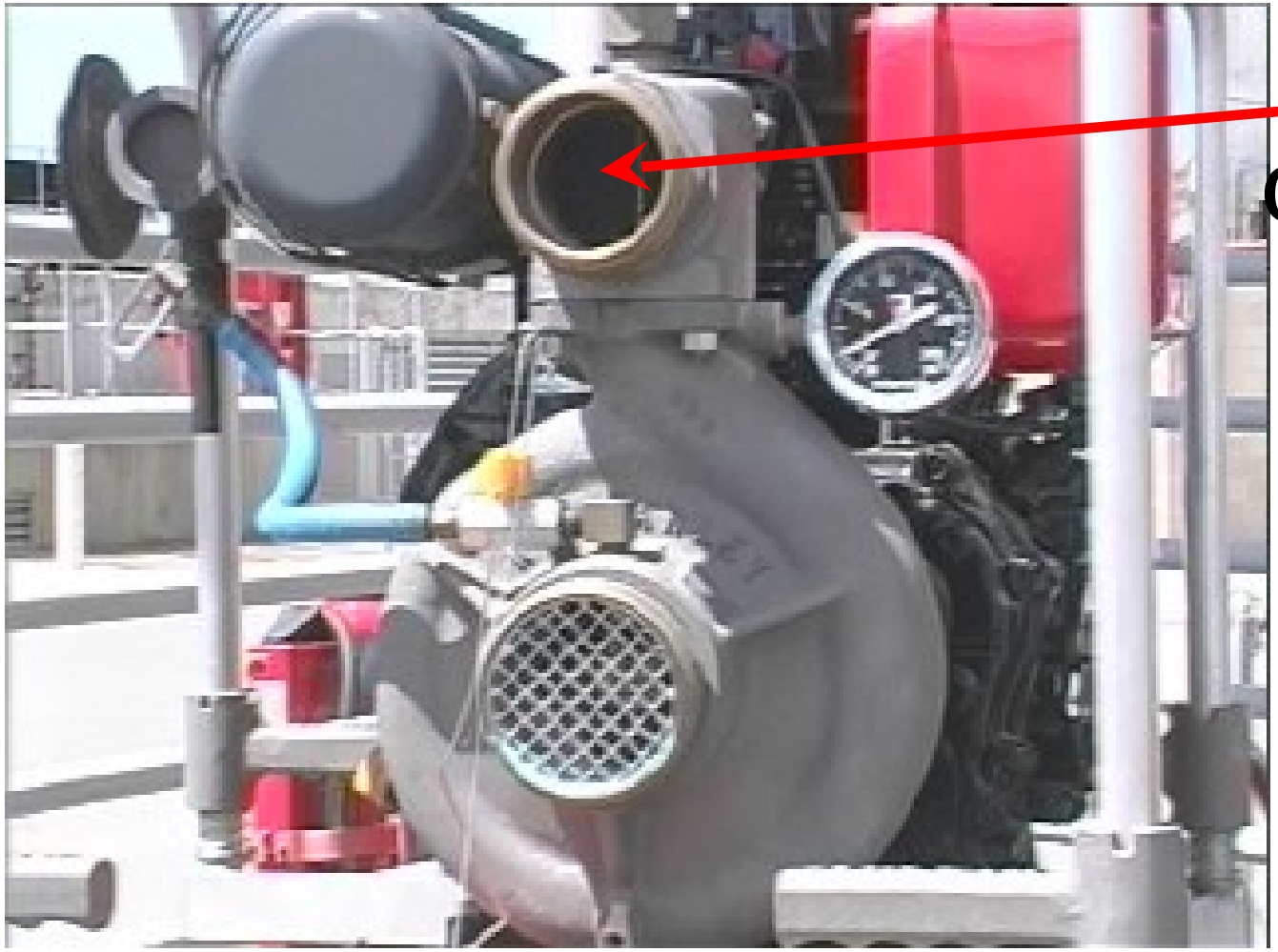


Oil check

P-100 portable fire fighting pump



P-100 portable fire fighting pump

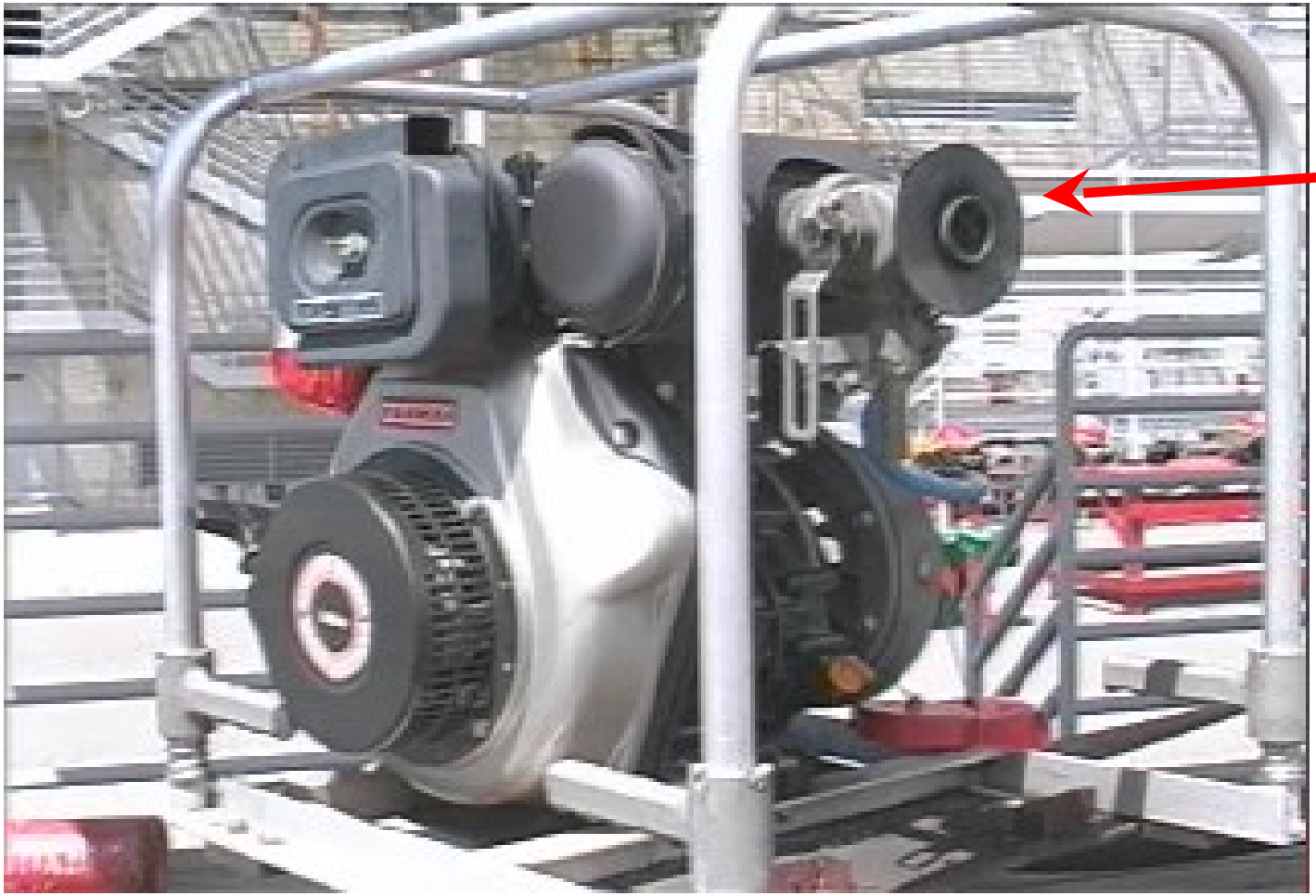


2 1/2”
discharge

P-100 portable fire fighting pump

Compound pressure gauge

P-100 portable fire fighting pump



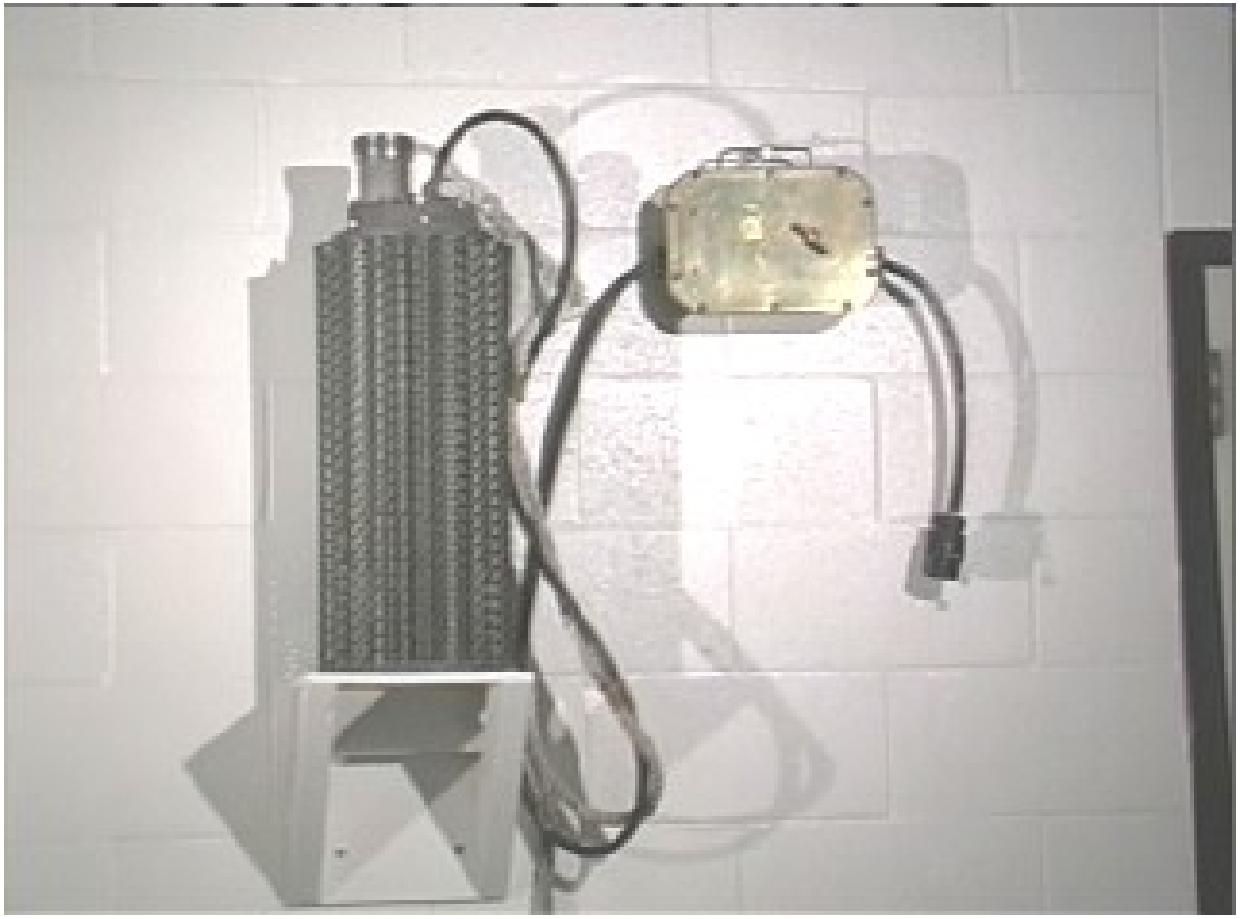
Portable electric submersible pump

- 3 phase 440 volt AC
- Pump uncontaminated fresh or salt water
- Not designed to pump gasoline, heavy oils or hot water
- DFM, JP-5 & Navy Distillate (ND) may be pumped safely in emergency situations with Chief Engineers Permission

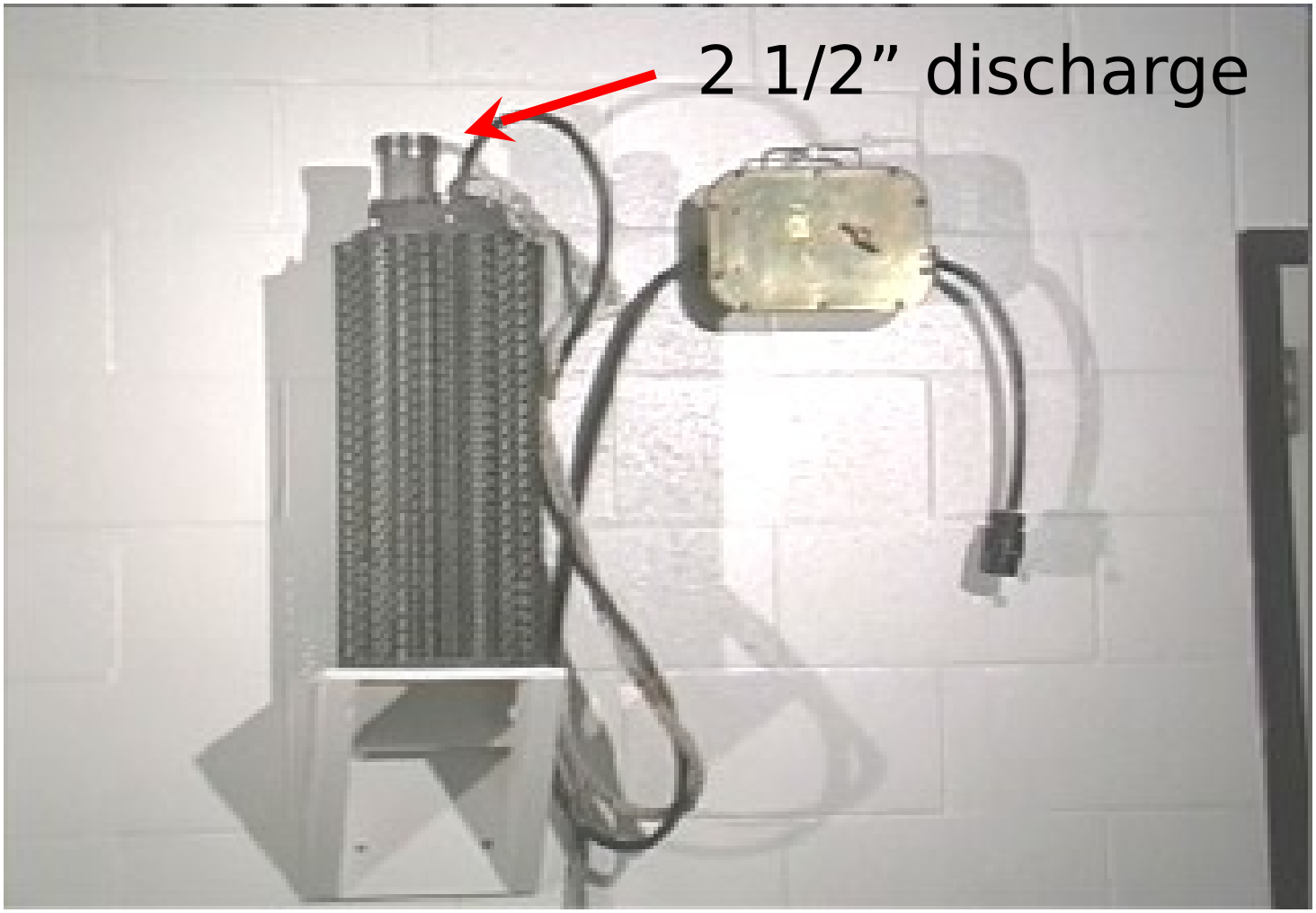
Portable electric submersible pump

- Capacities
  - 200 GPM at a 50’ static head
  - 140 GPM at a 70’ static head
  - Suction lift of 20’
- Operation
  - Used in tandem to increase static head
  - Keep pump submerge while in operation
  - Keep strainer clean

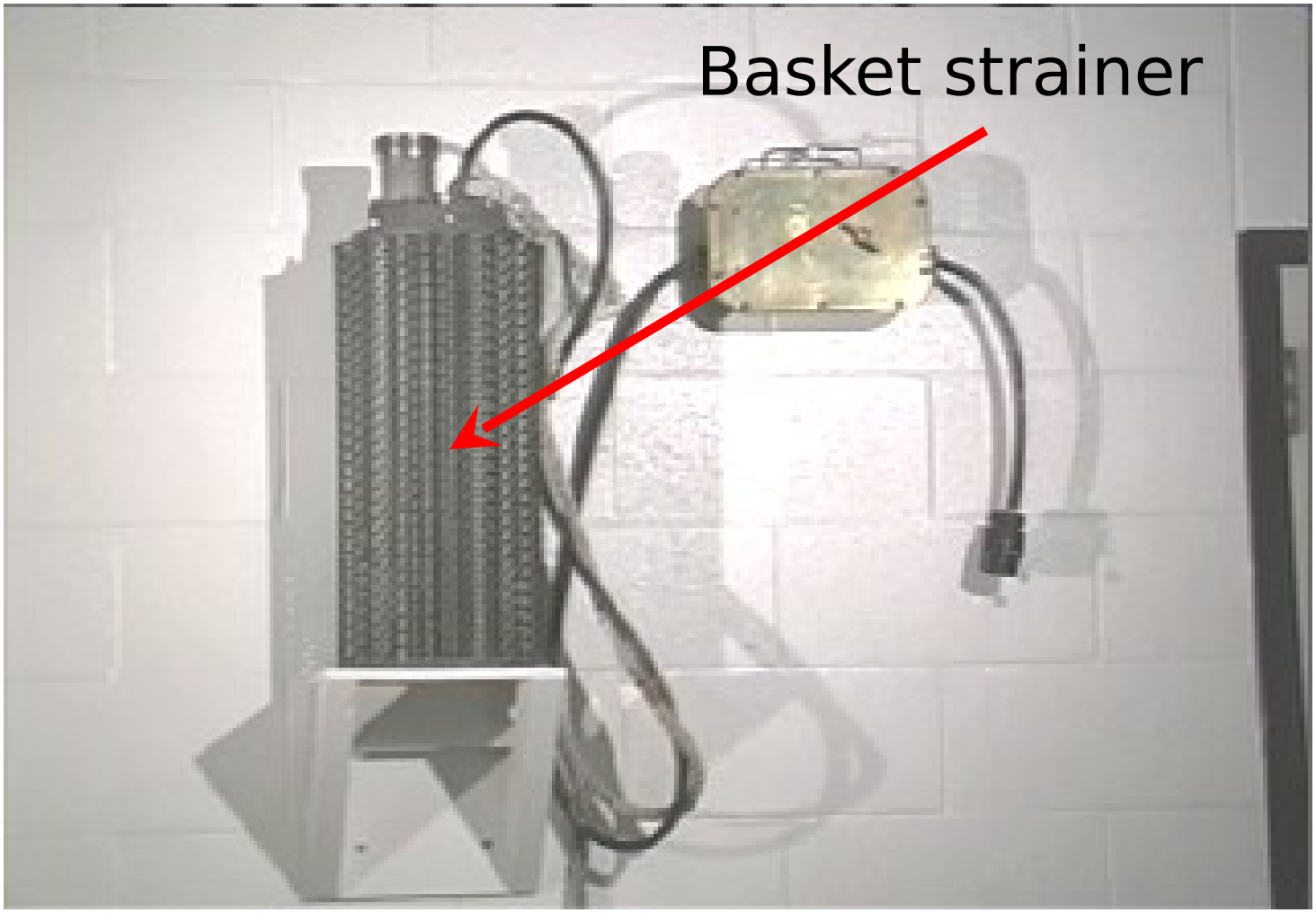
Electrical submersible pump



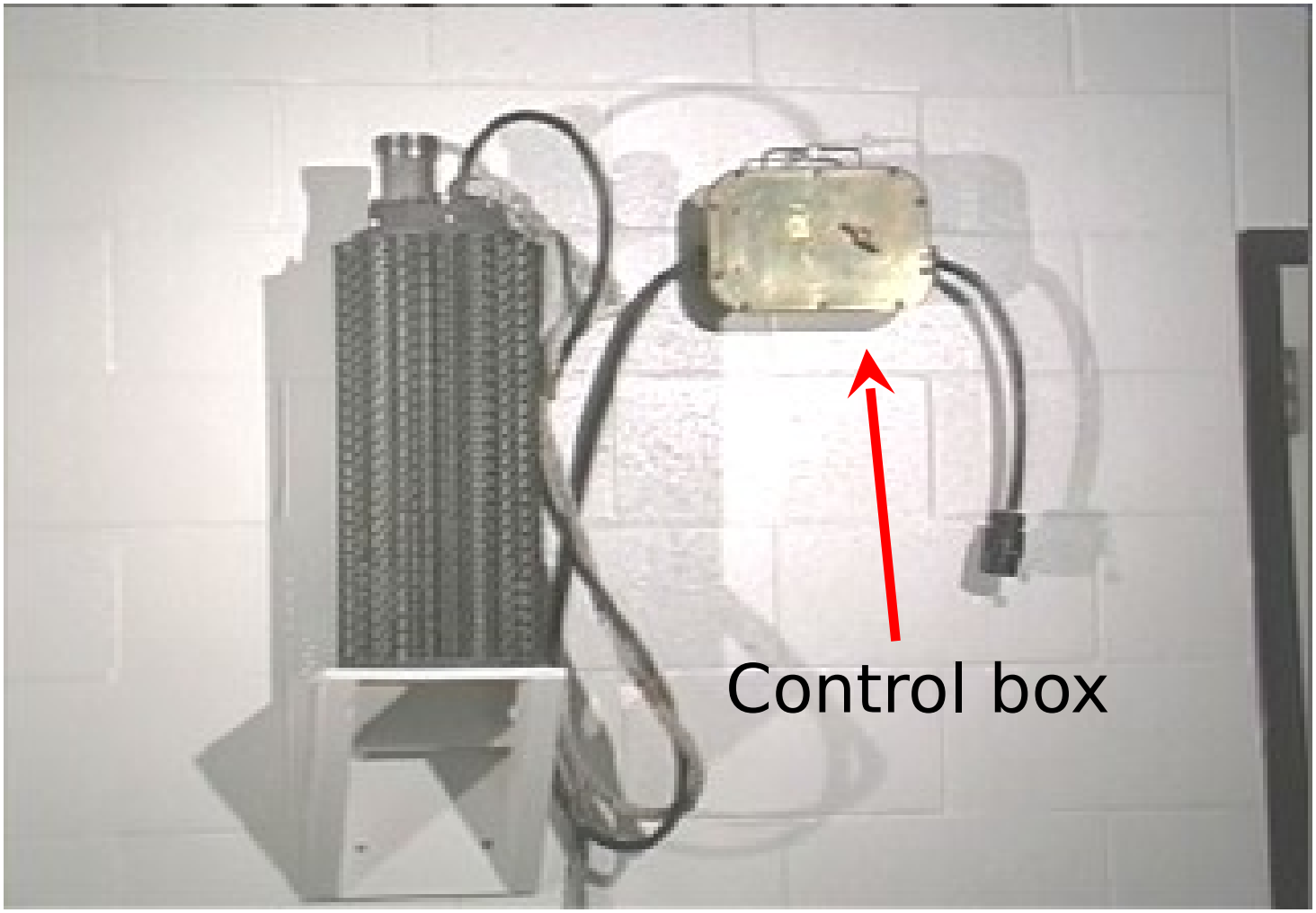
Electrical submersible pump



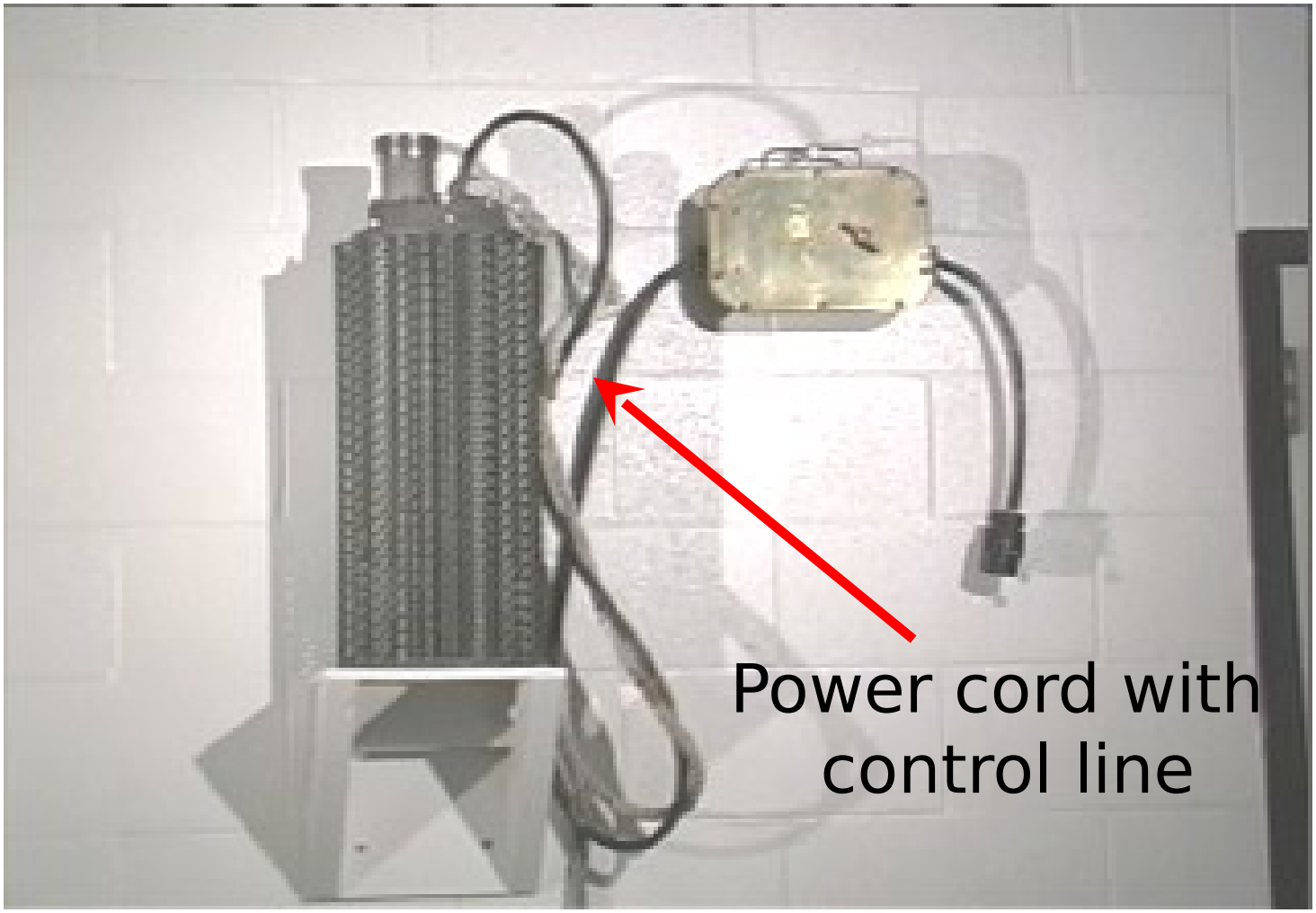
Electrical submersible pump



Electrical submersible pump



Electrical submersible pump



Emergency Repair to Decks and Bulkheads using Plugs

- Two general methods for repairing holes
  - Put something into it
  - Put something over it
  - Temporary patch not always watertight
  - No one type of plug/patch is correct for all types of leaks

Wooden plugs

- Simplest method
- Made of soft wood
  - Douglas fir
  - yellow pine
- Not painted
- Combinations of plugs may be used

Emergency Repair to Decks and Bulkheads using Plugs

- Pillows, mattresses
  - Pillows and mattresses can be rolled up
  - Cannot be relied upon

Plate patches

- Used on holes with metal protruding inward
- Plate patches can be made from tables, mattress, steel plates
- Hinged folding plate patch
  - Circular plate, 18 inches or less in diameter
  - Passes through hole in folded position and tightened with line

Wooden box patch

- Used for holes up to 4 feet square and one foot deep
- Can be shaped t
  corrugations or
- Used on holes
  inward

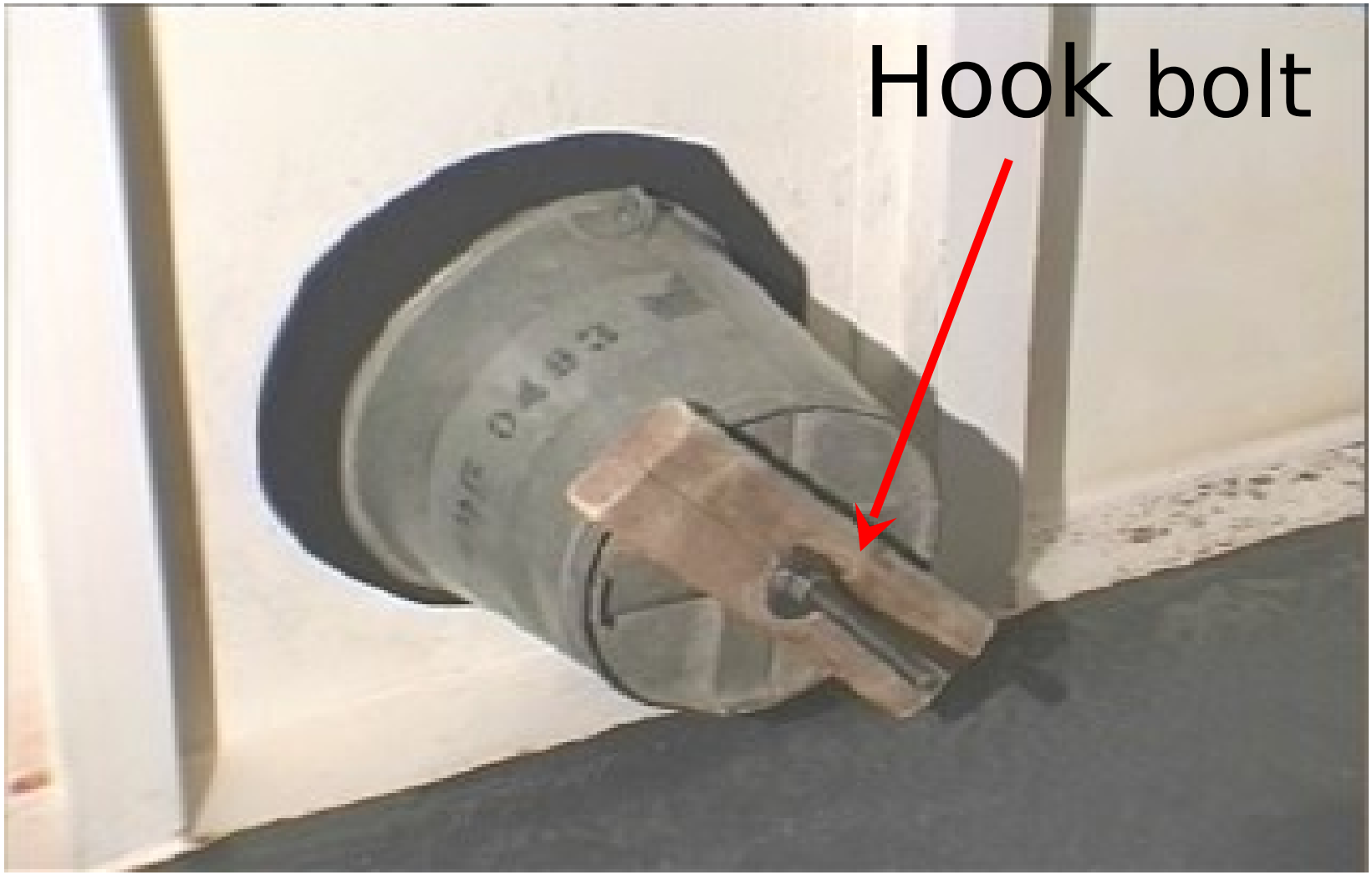
Box patches & Bucket Patch

- Metal box patch
  - Holes up to 18” square and 6” deep
  - Suited for holes with jagged edges protruding inward
  - Shored or welded in place
- Bucket Patch
  - Galvanized bucket with gasket material
  - Held in place by shores or by hook bolts

Bucket patch

Bucket patch

Bucket patch



Hook bolts

- Long bolts shaped so that bolt can be hooked to plating through holes
  - Types are: T, J, and L
  - Shanks are threaded with nuts and washers
- Folding T hook bolts
  - Resembles T hook bolt, but has hinge

Patches for cracks and split seams

- Drill/cut 1/4” hole at each end of crack
- Apply gasket over length of crack
- Shore with sholes or strongback to hold gasket
- Use caulking, oakum, cloth, marlin, canvas, for split seams or cracks

Cofferdams

- Small compartment inside a larger one
- Used around extra large holes
- Used around enclosures such as hatches, trunks, and doors
- Used to enter a compartment below a flooded space

Emergency Pipe Repairs

- Types of ruptures
  - Simple
  - Elbow
  - Severed
  - Compound
- Types of patches
  - Jubilee pipe patch
    - Prefabricated sheet metal collar secured over packing with bolts or clamps
    - Holds upwards of 100 PSI

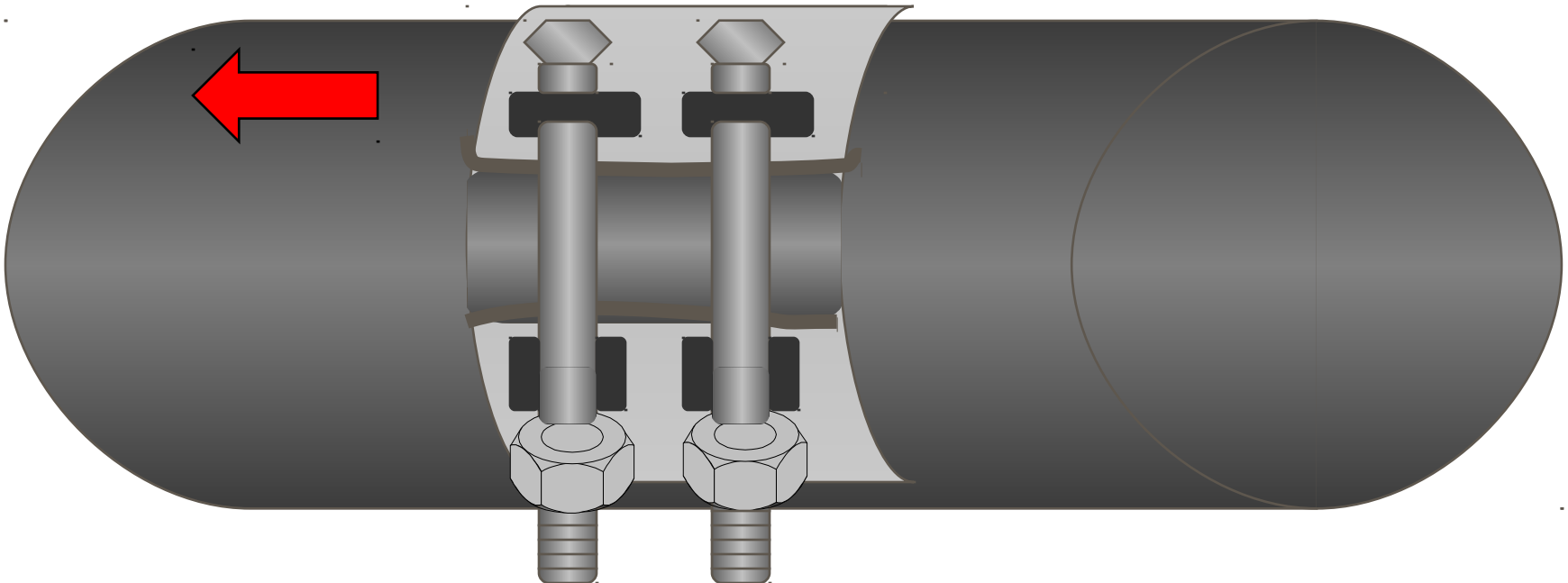
Jubilee Patch

- 1. Secure pressure if possible
- 2. Remove rough edges if possible

Jubilee Patch

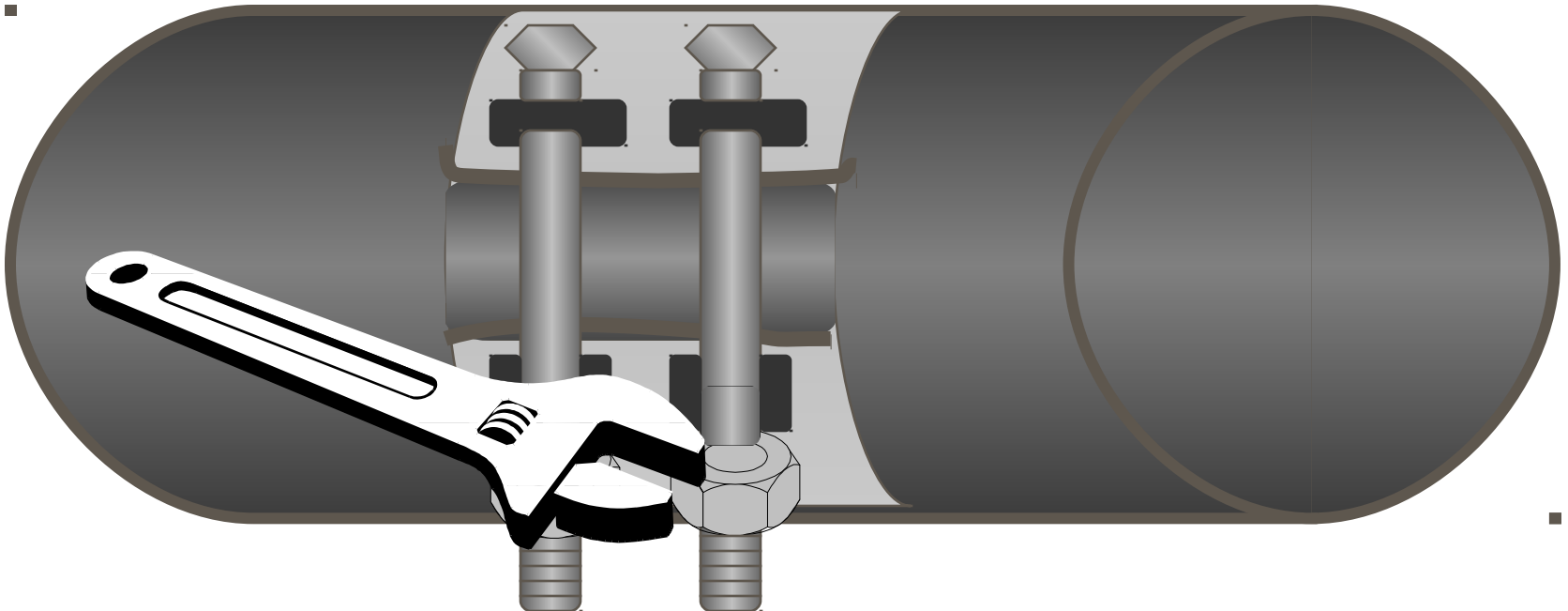
3.Place Patch down stream from rupture,

4 & 5. Slide Patch Over Rupture, and Equalize spray from sides of patch.



Jubilee Patch (Cont..)

- 6. Tighten bolt with adjustable wrench until flow ceases.
- 7. Holds pressure upwards of 100 PSI.



Emergency Pipe Repairs

- Soft patch
  - Used to repair small holes/cracks piping
  - 150 PSI or less
- How to install soft patches
  - Secure pressure, Remove rough edges
  - Insert wedge(s) into rupture
  - Mark wedge, Remove wedge & cut 1/2” below mark
  - Tap wedge back into rupture, use a rag or oakum with wedge

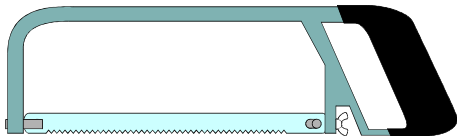
How to install soft patches

- Cut off excess of wedge flush with pipe
- Gasket, 2” overlap on both sides and a 1/4 gap at bottom
- Place rubber over rupture
- Start wrapping with marlin at center and overlap patch 1/2 inch on both sides
- Tie off marlin and test

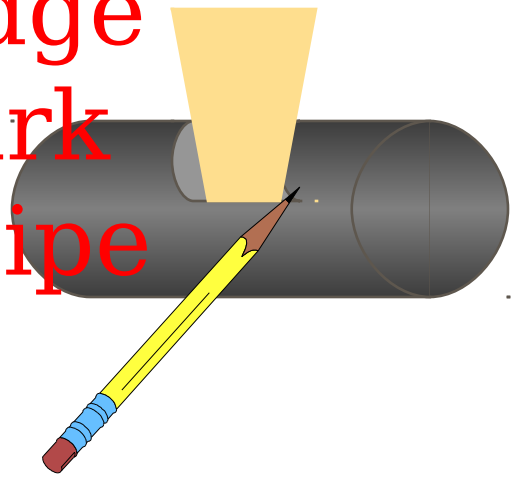
Soft Patch

1. Secure Water

2. Remove Rough Edges.

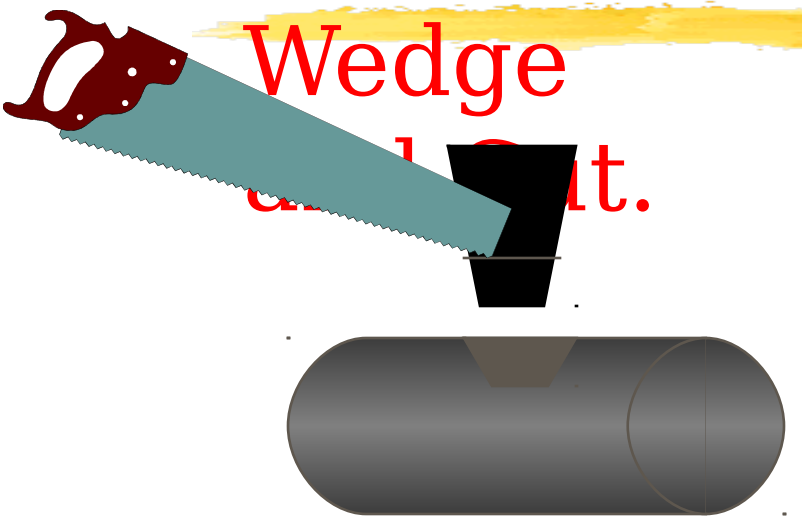


3.Insert Wedge or Plug, Mark Even With Pipe

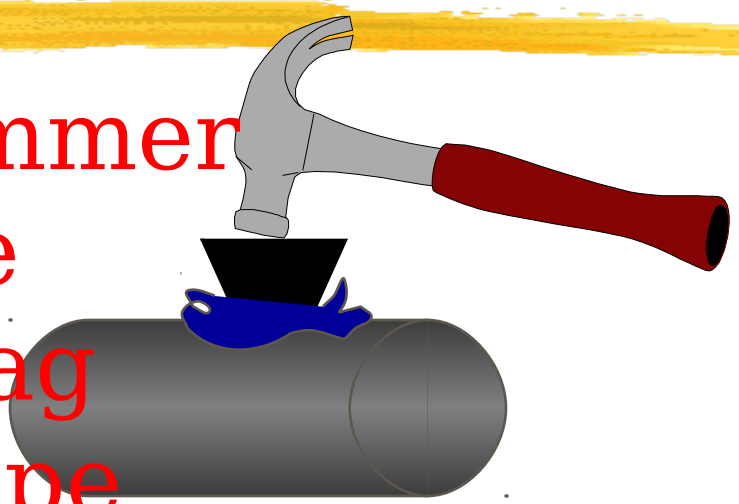


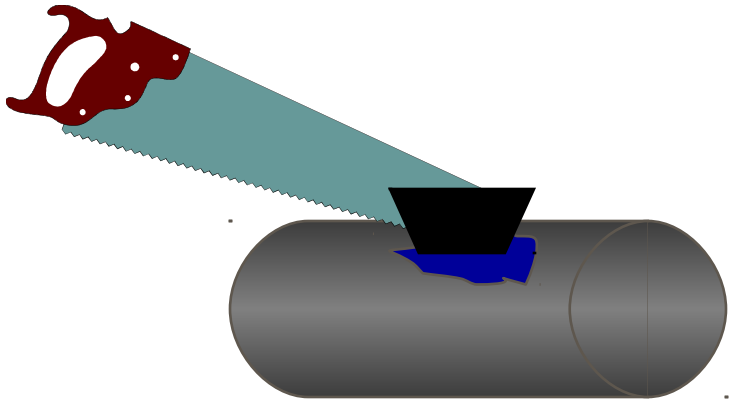
Soft Patch

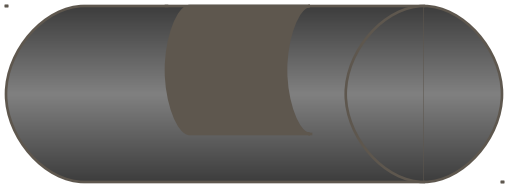
4. Remove Wedge and Cut.



5. Hammer Wedge and Rag into pipe



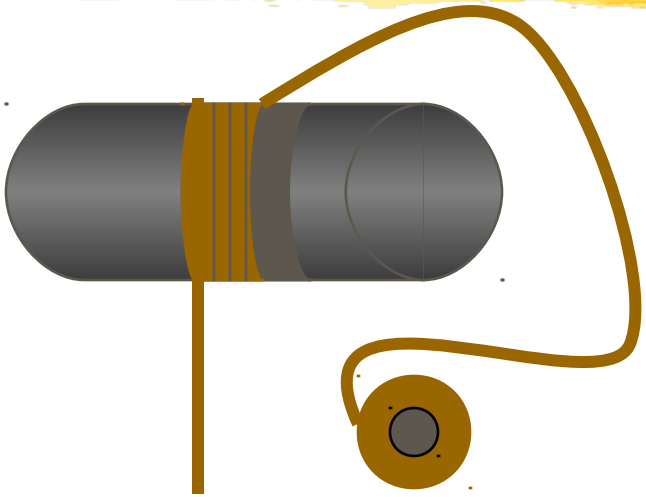




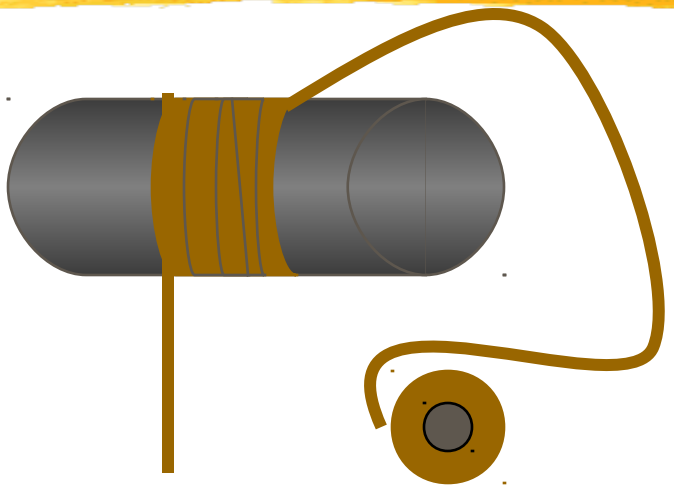
6. Cut Flush With Pipe.

7. Place Rubber Sh
Over Damage

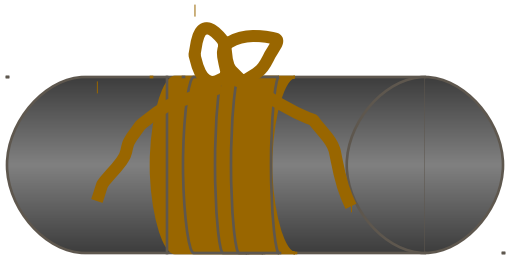
Soft Patch



9. Wrap with Marlin, Starting with center



10. Make 2 Tight Wraps



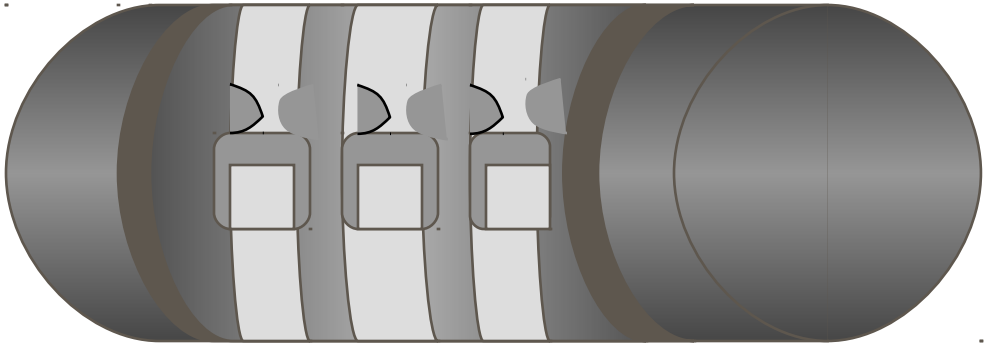
11. Tie off at center

3. Band-it-Patch

- A comparatively simple patch to install. Used primarily on fresh and saltwater systems. Produces a very effective repair.

A. Equipment

- 1. Band-it Tool
- 2. 100 ft roll of strapping
- 3. Banding Clips
- 4. Rubber sheet
- 5. Metal Backing Plate
- 6. Face shield
- 7. Gloves



Emergency Pipe Repairs

- Banding kit
  - Used to repair small holes or cracks piping
  - 150 PSI or less
- How to install a banding patch
  - Secure pressure and remove rough edges
  - Place rubber gasket over hole, 2 inch overlap on all sides
  - Place metal plate over gasket
  - Place bands over patch and secure with tool and test

Emergency Pipe Repairs

- Emergency water activated repair patch(EWARP)
  - Size 1, 2" X 5' 10 packs per box
  - Size 2, 4" X 15' 10 packs per box
  - Latex gloves
  - safety glasses
  - Instructional sheet
  - Fiberglass gauze type material
  - Shelf Life - 24 Months

Emergency water activated repair patch(EWARP)

- Repair process
  - Remove loose rust, scale, jagged and protruding edges
  - Put on plastic gloves and glasses
  - Immerse in fresh water for 20 seconds and wrap around pipe
  - Patch will become solid in 15 minutes with 30 minute cure time

Emergency water activated repair patch(EWARP)

- EWARP advantages
  - Applied to piping systems, fittings, and can be used to repair cracks & small holes
  - Excellent adhesive qualities when applied to steel and copper materials
  - Fresh water, except potable water inlet lines, salt water, hydraulic and lubricating oils
  - Not used on steam or fuel lines

Emergency water activated repair patch(EWARP)

- EWARP advantages
  - Maximum pressure of 150 PSI
  - Maximum temperature 300 degrees Fahrenheit
- Safety precautions
  - Wear gloves and safety glasses
  - Avoid contact with unprotected areas of skin or eyes.
  - Consult MSDS for additional information

Summary and Review

- Flooding Indications, Causes, and Sources
- Effects of Pressure on Flooding
- Effects of Securing Sources of Flooding
- Effects of Establishing Flooding Boundaries
- Controlling Flooding using Portable and Installed Dewatering Systems
- Emergency Repair to Decks and Bulkheads using Plugs

Summary and Review

- Emergency Repairs to Decks and Bulkheads using Patches
- Emergency Pipe Repairs